B3 cont.

are connected to the electrode terminals of the circuit board,

wherein said semiconductor device bridges the space between the display panel and the circuit board.

REMARKS

This application has been reviewed in light of the Office Action dated February 27, 2001. Claims 1-29 remain pending in this application. Claims 1 and 13 have been amended to define still more clearly what Applicants regard as their invention. Claims 1 and 13 are in independent form. Favorable reconsideration is requested.

The specification has been carefully reviewed and amended as to matters of form.

The Office Action rejected Claims 1-3, 7, 13, and 18, under 35 U.S.C. § 103(a) as being unpatentable over Applicants' admitted prior art in view of U.S. Patent No. 5,467,210 (Kishigami). In addition, the Office Action rejected Claims 4, 6, 15, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Applicants' admitted prior art in view of Kishigami and further in view of U.S. Patent No. 5,311,341 (Hirai).

Applicants submit that independent Claims 1 and 13 are patentably distinct from the cited prior art for at least the following reasons.

The aspect of the present invention set forth in Claim 1 is directed to a circuit connection structure. The structure includes a first substrate that forms a display panel that has electrode terminals formed thereon. A semiconductor device has first electrodes and second electrodes with the first electrodes being directly connected to the electrode terminals of the first substrate. A flexible wiring member is disposed in a lateral position with respect to the first substrate having thereon a pattern of conductors, each extending from a first conductor end to a second conductor end on the flexible wiring member with the first conductor ends of the conductors connected to the second electrodes of the semiconductor device. A circuit board is disposed with a space from the first substrate and has electrode terminals connected to the second conductor ends of the conductors on the flexible wiring member. The semiconductor device bridges the space between the first substrate and the circuit board.

One important feature of Claim 1 is that the circuit connection structure includes a circuit board that is disposed with a space from the first substrate and has electrode terminals connected to the second conductor ends of the conductors on the flexible wiring member and the semiconductor device bridges the space between the first substrate and the circuit board.

The Examiner approved Applicants' drawing corrections that were filed on November 21, 2000. The drawing corrections included, among other things, adding the words "Prior Art" to Figures 12, 13, and 14. The recited structural features, shown for example in Figure 2, are distinguishable from the structural features in Figure 13 for at least the following reasons:

(i) the recited display panel, as can be seen in Figure 2, which includes a first substrate (e.g., 1b), advantageously provids a larger area of effective display region, without using a large area for setting a semiconductor device (e.g., 5) on the first substrate,

(ii) the length of the recited flexible wiring member (e.g., 4a), liable to cause an increase input wiring impedance to the liquid crystal panel, is minimized by the recited structure to a length that is required to connect between the circuit board (e.g., 3) and the semiconductor device striding over the circuit board, thus effectively suppressing the increase of the input wiring impedance, and

(iii) the semiconductor device disposed to bridge the space between the first substrate and the circuit board functions to suppress a relative movement between these members, thereby suppressing a stress caused by the relative movement from acting on the flexible wiring member, minimizing the chances of a

failure of connection with the flexible wiring member.

In contrast, in the prior art structure shown in Fig. 13, the semiconductor device (5p) is disposed only on the circuit board (3p), and the flexible wiring members (4ap) are disposed on both sides of the semiconductor device (5p), thus requiring a longer input wiring length, which increases the input wiring impedance and consequently, makes it more difficult to realize a high-speed drive of a large-area liquid crystal panel.

Kishigami, as understood by Applicants, shows an arrangement of bonding IC chips to a liquid crystal display device and includes, among other things, a first board-shaped transparent substrate and a second board-shaped transparent substrate that are positioned opposite to each other (see Abstract). According to Figures 1 and 3 in the Kishigami LCD device, semiconductor devices are disposed only on a first substrate (12) for constituting a liquid crystal panel, thus narrowing the effective display area. Moreover, while Kishigami may suggest a flexible cable (30) connection, Kishigami is not seen to teach or suggest a circuit board structure that minimizes the wiring length to the liquid crystal panel. Consequently, Kishigami's structural features are not suitable for a large-area liquid crystal panel device driven at a high speed.

Applicants submit that a combination of Applicants

prior art and Kishigami, assuming such combination would even be permissible, would fail to teach or suggest the recited circuit board structure that minimizes the wiring length to the liquid crystal panel, as the structure in Claim 1 does.

The aspect of the present invention set forth in Claim 13 is directed to a display apparatus. The apparatus includes a display panel that is made up of at least one substrate that has pixel electrodes which extend to form electrode terminals on a peripheral side of the substrate. A semiconductor device has input electrodes and output electrodes for supplying drive waveforms to the pixel electrodes of the display panel. A circuit board is disposed with a space from the display panel and has electrode terminals for supplying an electric power and control signals to the semiconductor device. The electrode terminals on at least one substrate of the display panel are directly connected to the output electrodes of the semiconductor device and the semiconductor device is connected to the circuit board via a flexible wiring member that is disposed in a lateral position with respect to the substrate that has a pattern of conductors, each extending from a first conductor end to a second conductor end so that the input electrodes of the semiconductor device are connected to the first conductor ends of the conductors on the flexible wiring member. The second

conductor ends of the conductors of the flexible wiring member are connected to the electrode terminals of the circuit board, and the semiconductor device bridges the space between the display panel and the circuit board.

One important feature of Claim 13 is that the display apparatus includes a circuit board that is disposed with a space from the display panel and has electrode terminals for supplying an electric power and control signals to the semiconductor device, and the semiconductor device bridges the space between the display panel and the circuit board.

Hirai, as understood by Applicants, relates to an improved liquid-crystal display device that has a slit formed in part of the tape-automated bonding (TAB) area where the electrodes on the liquid-crystal display panel are connected to the output terminals on the TAB. The liquid-crystal display panel is bonded to the TAB by means of a first anisotropic conductive adhesive having a comparatively weak adhesive force. (See Abstract.) In Hirai, in Figure 1(b), a semiconductor device (5) is disposed only on a flexible wiring device (4), which increases the input wiring length and consequently, causes an increase in the input impedance to the liquid crystal panel, and like the prior art in Figure 13 and Kishigami, is not suitable for a large-area liquid crystal panel device driven at a high

speed.

Applicants submit that a combination of Applicants prior art, Kishigami and Hirai, assuming such combination would even be permissible, would fail to teach or suggest a display apparatus as recited in Claim 13 that minimizes the wiring length to the liquid crystal panel, as the apparatus in Claim 13 does.

Accordingly, Applicants submit that Claims 1 and 13 are patentable over the cited art, and respectfully request withdrawal of the rejection under 35 U.S.C. § 103(a).

The other rejected claims in this application depend from one or another of the independent claims discussed above, and, therefore, are submitted to be patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

This Amendment After Final Action is believed clearly to place this application in condition for allowance and, therefore, its entry is believed proper under 37 C.F.R. § 1.116. Accordingly, entry of this Amendment After Final Action, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested. Should the Examiner believe that issues remain outstanding, it is respectfully requested that

the Examiner contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York Office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

A section starting at page 2, line 19 and ending at page 3, line 10 has been replaced with the following section.

--The input electrodes and the output electrodes of each driver IC 5p are connected to the copper foil electrodes 17 and 32 on the input side and output side TCPs 4a, respective via gold bumps 15(p). The connections of each driver IC 5p are sealed with a resinous sealing agent 16p. In such a display panel connection structure for a display apparatus as shown in Figures 12 and 13, as the display panel (particularly a liquid crystal panel) is provided with a larger number of display electrodes at a higher density, the connection pitch for connection between the output electrodes of the TCPs and the electrode terminals on the transparent substrates are decreased down to a required pitch of 50 μm or smaller. However, according to a method for connecting TCP with a substrate as explained with reference to Figures 12 and 13, a very sophisticated and accurate bonding technique is required for ensuring such a minute connection pitch because of a limitation in size accuracy of TCPs

and a deviation due to thermal expansion during connection by heat bonding of TCPs. Therefore, a connection structure as shown in Figure 14 including bonding of driver ICs 5 to a substrate 1bp by a face-down mode has been proposed or ensuring such a minute connection pitch.--

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) A circuit connection structure, comprising: a first substrate forming a display panel having electrode terminals formed thereon, a semiconductor device having first electrodes and second electrodes with the first electrodes directly connected to the electrode terminals of the first substrate, a flexible wiring member disposed in a lateral position with respect to the first substrate having thereon a pattern of conductors each extending from a first conductor end to a second conductor end on the flexible wiring member with the first conductor ends of the conductors connected to the second electrodes of the semiconductor device, and a circuit board disposed with a space from the first substrate and having thereon electrode terminals connected to the second conductor ends of the conductors on the flexible wiring member,

wherein said semiconductor device bridges the space between the first substrate and the circuit board.

13. (Twice Amended) A display apparatus, comprising:

a display panel comprising at least one substrate

having thereon pixel electrodes extending to form electrode terminals on a peripheral side of the substrate,

a semiconductor device having input electrodes, and output electrodes for supplying drive waveforms to the pixel electrodes of the display panel, and

a circuit board disposed with a space from the display panel and having electrode terminals for supplying an electric power and control signals to the semiconductor device; wherein

the electrode terminals on at least one substrate of the display panel are directly connected to the output electrodes of the semiconductor device, and

the semiconductor device is connected to the circuit board via a flexible wiring member disposed in a lateral position with respect to the substrate having thereon a pattern of conductors each extending from a first conductor end to a second conductor end so that the input electrodes of the semiconductor device are connected to the first conductor ends of the conductors on the flexible wiring member, and the second conductor ends of the conductors of the flexible wiring member are connected to the electrode terminals of the circuit board,

wherein said semiconductor device bridges the space

between the display panel and the circuit board.

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